

WHAT IS CLAIMED IS:

1. An ion source comprising:

a plasma production vessel which serves as an anode;

5 a filament provided on one side of said plasma production vessel;

a reflector provided opposite said filament on the other side of said plasma production vessel and kept at a filament potential or a floating potential; and

10 a magnet for generating a magnetic field in a direction of connecting said filament and said reflector within said plasma production vessel,

wherein a relation

$$L < 3.37B^{-1}\sqrt{V_A} \times 10^{-6}$$

15 is satisfied, where the arc voltage applied between said plasma production vessel and said filament is  $V_A[V]$ , the magnetic flux density of the magnetic field within said plasma production vessel is  $B[T]$ , and the shortest distance from a most frequent electron emission point located almost at the tip center of said filament to a wall face of the plasma production vessel  
20 is  $L[m]$ .

2. The ion source according to claim 1, wherein the ion source is a Bernus type.

25 3. The ion source according to claim 1, wherein said

magnet is an electromagnet or a permanent magnet.

4. A method for operating an ion source which comprises a plasma production vessel serving as an anode, a filament provided on one side of said plasma production vessel, a reflector provided opposite said filament on the other side of said plasma production vessel and kept at a filament potential or a floating potential, and a magnet for generating a magnetic field in a direction of connecting said filament and said reflector within said plasma production vessel, the method comprising a step of leading out an ion beam with the following relation being satisfied,

$$L < 3.37B^{-1}\sqrt{V_A} \times 10^{-6}$$

where an arc voltage applied between said plasma production vessel and said filament is  $V_A[V]$ , a magnetic flux density of the magnetic field within said plasma production vessel is  $B[T]$ , and a shortest distance from a most frequent electron emission point located almost at the tip center of said filament to a wall face of said plasma production vessel is  $L[m]$ .

5. The method according to claim 4, wherein the ion source is a Bernus type.

6. The method according to claim 4, wherein said

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